ENERGY SAVINGS OPPORTUNITY SURVEY

FORT CAMPBELL, KENTUCKY

ENERGY AUDIT OF FORT CAMPBELL

FINAL REPORT

APRIL 1985

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EXECUTIVE SUMMARY

Prepared for

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ARMY CONTRACTS
NO. DACA27-84-C-0089; NO. DACA27-85-C-0171

DEPARTMENT OF THE ARMY
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Marie Wakefield,
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EXECUTIVE SUMMARY

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INTRODUCTION

1.1 BACKGROUND

This report is the final report of an Energy Savings Opportunity Survey (ESOS) study at Fort Campbell; Fort Campbell, Kentucky. Work was begun on the project after the kickoff meeting on July 24, 1984, by BENATECH, INC. under contract no. DACA27-84-C-0089 with the Louisville District, U.S. Army Corps of Engineers, Louisville, Kentucky. The following activities have been accomplished:

- A detailed field investigation has been conducted.
- ECO calculations have been performed and ECIP analyses have been accomplished.
- Interim Report has been submitted.
- Project documentation packages compiled.
- Executive Summary and Narrative put together.
- The Energy Efficient Motors Survey has been completed. The motors survey was conducted in November, 1985. The results of the Energy Conservation Measure (ECM) analysis are submitted as a supplemental report in Volume V.

1.2 SCOPE

The Scope of Work specified in contract no. DACA27-84-C-0089 (and included in this report as Appendix A) requires the performance of a specific energy study. The Energy Conservation Opportunities analyzed under this study will serve as part of Fort Campbell's overall effort to reduce basewide energy use in accordance with the objectives set forth in the Army Energy Plan. The contract Scope of Work (SOW) for Fort Campbell study outlines the following specific requirements:

- Perform a limited site survey to evaluate the buildings listed in Annex B of the contract Scope of Work.
- Evaluate selected ECO's in Annex B of the contract Scope of Work.
- Prepare project documentation for selected military construction projects (DD Form 1391 project development brochure (PDB) and project backup data (PBUD)).
- List and prioritize all recommended energy conservation projects.
- Prepare a comprehensive report which will document all work accomplished, the results achieved and the conslusions recommended.

A list of motors to be surveyed for the Energy Efficient Motors ECM was provided in the Scope of Work, contract no. DACA27-85-C-0171.

All of these Scopes of Work items have been accomplished.

2. ENERGY CONSERVATION OPPORTUNITIES (ECOs)

2.1 TECHNICAL APPROACH

The Scope of Work contains a list of specific ECOs to be studied for Fort Campbell. These ECOs were investigated after completing our field survey visits (there was a primary two week long visit and several other 1-4 day visits) and compiling the raw data from the visits. The reason for collecting the field data are:

- Obtain nameplate data and sequence of operation for various building mechanical and electrical systems.
- Inspect type and condition of controls for various H.V.A.C. systems.
- Take field measurements on equipment and buildings for various projects.

Using the field data, the various ECOs were analyzed for their feasibility of being enacted under Army guidelines.

The analysis for the Energy Efficient Motors ECM was completed in two phases. The first phase consisted of an on-site survey taking inventory of the motors, including nameplate data and voltage and amperage measurements. The second phase involved creating a Lotus 1-2-3 model to analyze the technical and financial aspects of the ECM.

2.2 ECOs ANALYSIS

The following ECOs were analyzed as required by Annex B in Scope of Work.

- Chiller Tube Cleaner Analysis. This ECO analyzes the potential of using and automatic chiller tube cleaner system on the chillers listed in Annex B in Scope of Work. This ECO is the complete reanalysis of the chiller tube cleaner analysis in the basewide EEAP study.
- Radiant Heating Analysis. This ECO analyzes the potential of using high temperature radiant heating in the buildings listed in Annex B in Scope of Work. This ECO is the complete reanalysis of the radiant heating analysis in the basewide EEAP study.
- EMCS Analysis. This ECO analyzes the potential of expanding the present basewide EMCS system to the buildings listed in Annex B in Scope of Work.
- Window Panel Replacement Analysis. This ECO analyzes the potential of replacing the present window panels in the barracks with smaller double pane windows and insulation board.
- Oxygen Trim System Analysis. This ECO analyzes the potential of using an oxygen trim system on the central plant boilers.
- Heat Recovery Analysis. This ECO analyzes the potential of using heat recovery on the refrigeration systems for domestic water heating and space heating.
- Fluorescent Conversion Analysis. This ECO analyzes the potential of converting the incandescent lighting in the barracks to fluorescent lighting.
- Heat Pump For Domestic Water Analysis. This ECO analyzes the potential of using heat pumps for domestic water heating in the barracks.

Another ECO analyzed was the retrofit of 34 watt fluorescent lamps in place of 40 watt lamps. This ECO was requested by the installation and is included in the back portion of fluorescent conversion analysis.

3. RESULTS, CONCLUSIONS AND RECOMMENDATIONS

3.1 RESULTS

The majority of the Energy Conservation Opportunities evaluated met the Army guidelines for Energy Conservation Investment Program by having savings to investment ratio (SIR) of one or greater. These ECOs and their corresponding SIRs are: Chiller Tube Cleaner Analysis (SIR = 2.75), Radiant Heating Analysis (SIR = 2.53), EMCS Analysis (SIR = 2.49), Window Panel Replacement (SIR = 1.60), Oxygen Trim Analysis (SIR = 1.59), Fluorescent Conversion Analysis (SIR = 1.13). Table ES.1 list ECOs with SIR > 1.00 and are considered for ECIP.

The installation directed that the Heat Recovery Analysis be considered for the Productivity Enhancing Capital Investment Program (PECIP). The Heat Recovery Analysis has an SIR = 1.29. Table ES.2 list ECOs that are considered for PECIP.

The Heat Pump for Domestic Water Analysis did not meet the Army guidelines for Energy Conservation Investment Program. The Heat Pump for Domestic Water Analysis has a SIR = 0.49. Table ES.3 list ECOs that are not recommended for Fort Campbell because SIR < 1.00.

The results of the Energy Efficient Motors Analysis indicated that retrofitting the eligible motors on the base would be an effective ECM. Implementation of this project will save 11,872 MBTU/yr of electrical energy. The first year savings is $44,823, and simple payback is 4.49 years.

3.2 CONCLUSIONS

The Chiller Tube Cleaner Analysis, Radiant Heating Analysis, EMCS Analysis, Window Panel Replacement Analysis, Oxygen Trim Analysis and Fluorescent Conversion Analysis have SIRs greater than 1.00 and will help the facility meet the Army Energy Plan.

Although the Heat Recovery Analysis has a SIR greater than one, it does not meet the PECIP requirement of an amortization period of less than four years; therefore, a PECIP package was not prepared.

The Heat Pump for Domestic Water Analysis does save substantial amounts of energy; however, the high material cost and low natural gas rates cause this ECO to have a SIR less than one. This ECO does not meet Army criteria.

The Energy Efficient Motors Analysis is required to decrease the electrical energy consumption of the motors on the base. This ECM will contribute to the energy reduction goals established for U.S. Army Facilities.

TABLE ES.1

LIST OF E.C.O.s WITH SIR>1.00 AND ARE CONSIDERED FOR ECIP

E.C.O. TITLE	INVESTMENT COST ($)	ANNUAL ENERGY SAVINGS TYPE	AMOUNT(MBTU)	ANNUAL DOLLAR SAVINGS($)	S.I.R.	PAYBACK YEARS
*AUTOMATIC CHILLER TUBE CLEANER ANALYSIS	$398,236	ELECTRIC NAT. GAS	6962 14041	$76,101	2.75	5.2
*RADIANT HEATER ANALYSIS	$451,435	NAT. GAS	19547	$75,842	2.53	6.0
EMCS ANALYSIS	$548,322	ELECTRIC NAT. GAS	19799 7119	$107,982	2.49	5.1
WINDOW PANEL REPLACEMENT ANALYSIS	$151,712	ELECTRIC NAT. GAS	1705 2891	$17,355	1.60	8.7
OXYGEN TRIM SYSTEM ANALYSIS	$7,158	NO.2 FUEL NAT. GAS	140 5	$767	1.59	9.3
FLUORESCENT CONVERSION ANALYSIS	$688,533	ELECTRIC	16103	$85,102	1.13	8.1

* RE-EVALUATED FROM PREVIOUS BASEWIDE EEAP STUDY.

TABLE ES.2

LIST OF E.C.O.s CONSIDERED FOR PECIP FUNDING

E.C.O. TITLE	INVESTMENT COST ($)	ANNUAL ENERGY SAVINGS TYPE	(MBTU)	ANNUAL DOLLAR SAVINGS ($)	S.I.R.	PAYBACK (YEARS)
HEAT RECOVERY ANALYSIS	$49,260	ELECTRIC NAT. GAS	1,387 129	$5,069	1.29	9.7

TABLE ES.3

LIST OF E.C.O.s THAT DO NOT MEET ECIP CRITERIA

E.C.O. TITLE	INVESTMENT COST ($)	ANNUAL ENERGY SAVINGS TYPE	(MBTU)	ANNUAL DOLLAR SAVINGS ($)	S.I.R.	PAYBACK (YEARS)
HEAT PUMP FOR DOMESTIC WATER ANALYSIS	$498,249	ELECTRIC NAT. GAS	-3803 7973	$10,346	0.49	48.2

3.3 RECOMMENDATIONS

The analyses that have SIRs > 1.00 and meet ECIP criteria should be grouped together to form programming and implementation documentation. Four groups of documentation were designated by the installation. These groups are:

1. EMCS Analysis and Oxygen Trim System Analysis
2. Window Panel Replacement Analysis and Fluorescent Conversion Analysis
3. Radiant Heating Analysis
4. Chiller Tube Cleaner Analysis

Table ES.4 list these four projects and the Energy Efficient Motors ECIP package according to SIR. Graph GES.1 shows each group energy savings as a percentage of total recommended energy savings. Graph GES.2 shows each group project cost as a percentage of total calculated project cost. Project documentation is provided in Volumes IV and V.

The enactment of these five projects will result in a savings of 100,184 MBTUs of energy and $407,972 annually at an initial investment cost of $2,446,735. Table ES.5 lists the basewide energy usage for FY 84 with the savings achieved by the five projects subtracted in order to determine future base energy usage.

The recommendation for the Heat Recovery Analysis is the project be funded with base funds or a third party who is interested in a shared savings program.

The Heat Pump for Domestic Water Analysis should be reevaluated for installation if the cost of natural gas increases substantially faster than electricity or the installation cost of heat pumps decreases moderately.

Recommendations regarding the Energy Efficient Motor Analysis are two-fold. First, BENATECH recommends the replacement of selected existing motors throughout the base with premium efficiency motors. Second, BENATECH recommends that when any motor burns out, it should be replaced with an energy efficient motor.

TABLE ES.4

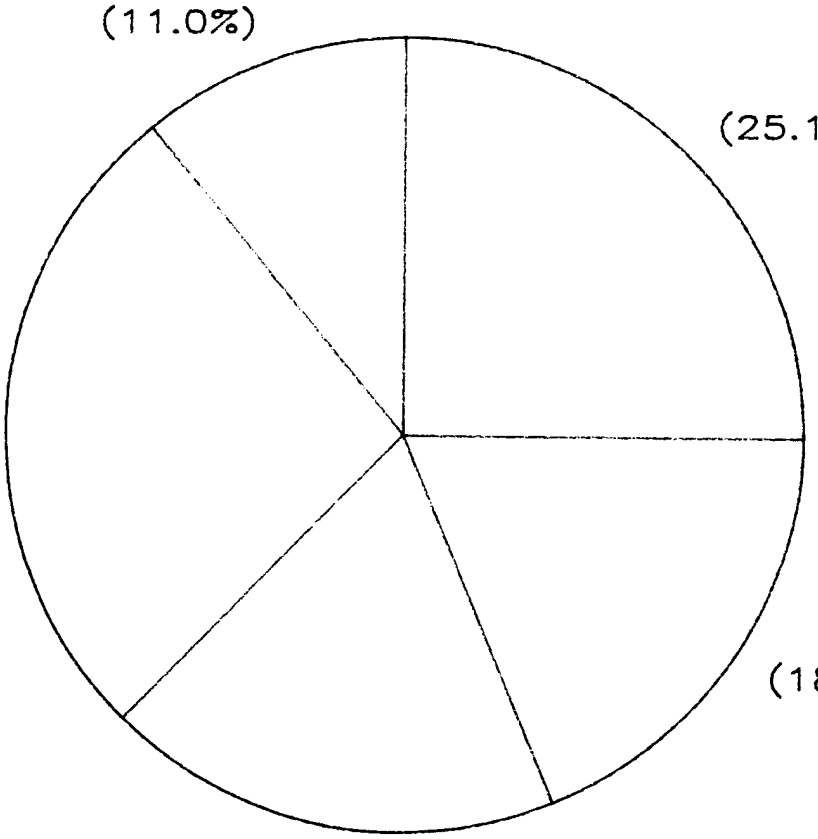
LIST OF DOCUMENTED ECIP PROJECTS

ECIP TITLE	INVESTMENT COST ($)	ANNUAL ENERGY SAVINGS TYPE	AMOUNT(MBTU)	ANNUAL DOLLAR SAVINGS($)	S.I.R.	PAYBACK YEARS	CWE($K)
AUTOMATIC CHILLER TUBE CLEANER PROJECT	$398,236	ELECTRIC NAT. GAS	6,962 14,041	$76,101	2.75	5.2	$427
ENERGY EFFICIENT MOTORS ANALYSIS	$201,339	ELECTRIC	11,872	$44,823	2.54	4.5	$237
RADIANT HEATER PROJECT	$451,435	NAT. GAS	19,547	$75,842	2.53	6.0	$534
EMCS AND OXYGEN TRIM SYSTEM PROJECT	$555,480	ELECTRIC NAT. GAS NO.2 FUEL	19,799 7,124 140	$108,749	2.47	5.1	$657
WINDOW PANEL REPLACEMENT AND FLUORESCENT CONVERSION PROJECT	$840,245	ELECTRIC NAT. GAS	17,808 2,891	$102,457	1.43	8.2	$994

INVESTMENT COST FOR FY 84; CWE FOR FY 88 COSTING
EXCEPT FOR ENERGY EFFICIENT MOTORS ANALYSIS WHERE INVESTMENT COST IS FOR FY 86
AND CWE IS FOR FY 90 COSTING

PROJECT SAVINGS

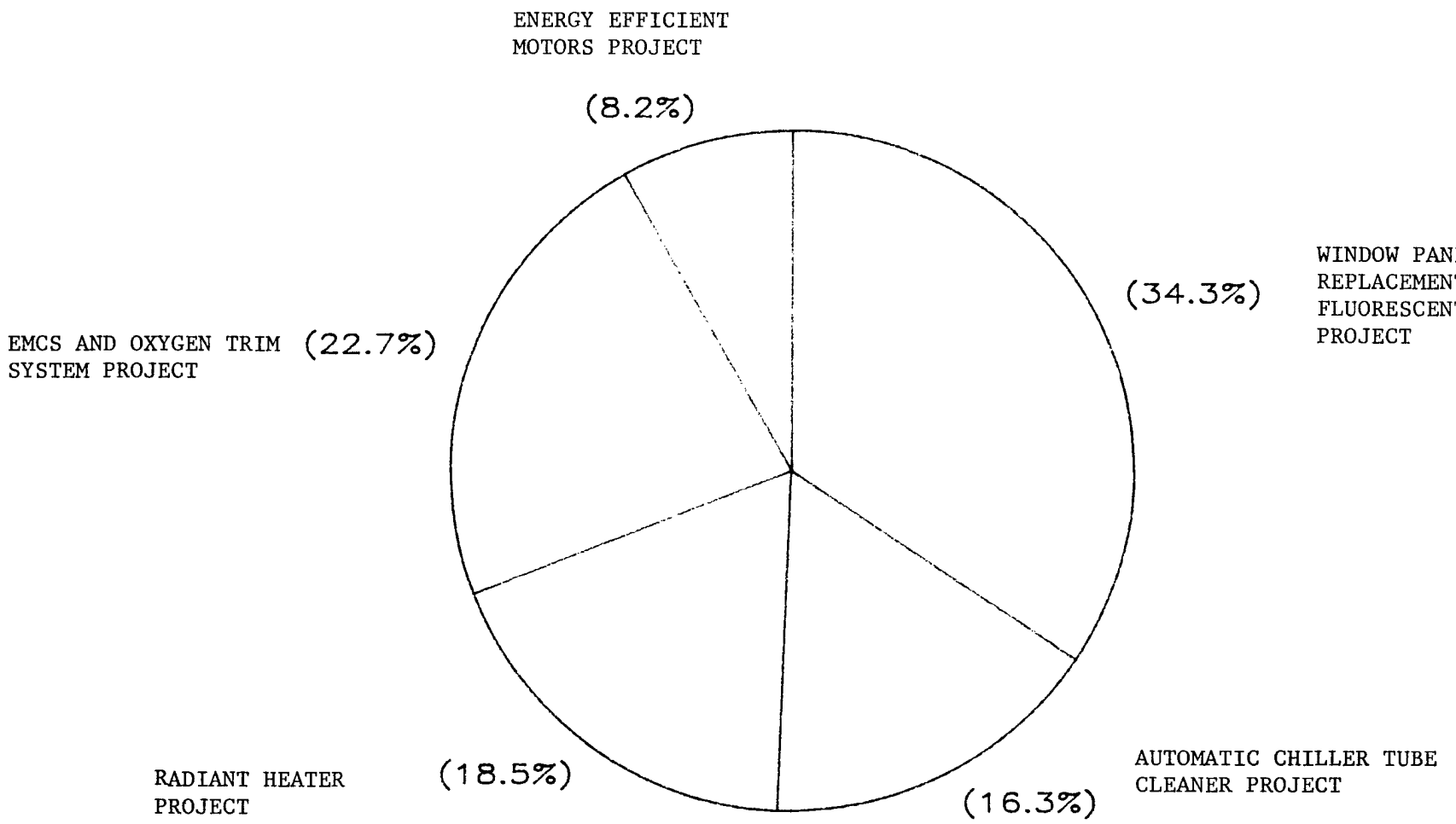
percentage of total savings



GRAPH GES. 1

PROJECT COST

percentage of total cost



GRAPH GES. 2

TABLE ES.5: LIST OF BASEWIDE ENERGY USAGE FOR FY84
(INCLUDING ESOS SAVINGS AND ESTIMATED FUTURE ENERGY USAGE)

	ENERGY TYPE (MBTU)						
	ELECTRICITY	# 2 FUEL OIL	# 5 FUEL OIL	NATURAL GAS	PROPANE	PURCHASED STEAM	TOTALS
PRESENT CONSUMPTION FY 84	2,330,992	144,153	116,067	1,476,372	25,536	3,264	4,096,384
ENERGY SAVED	56,441	N/A	140	43,603	N/A	N/A	100,184
FUTURE CONSUMPTION (After ECO Implementation)	2,274,551	144,153	115,927	1,432,769	25,536	3,264	3,996,200

N/A = NO ENERGY SAVINGS